

or a sect.”* It is something of an article of faith, to be accepted without question or challenge. Doctrine in this definition has long been and still is part and parcel of many scholarly disciplines and of much human behavior. And it must be admitted that there is still much in medicine that is more doctrinal than truly scientific. But it is the genius of present-day science that sooner or later whatever is doctrine or theory or simply belief will be questioned, put to crucial test, and if found wanting either modified to fit the known facts or else cast aside.

Modern science is based upon a recognition of inherent order in the universe, an order which includes life itself. Scientific progress occurs when knowledge of this order is increased or when the capability of man to manipulate the order is improved. Science as we think of it today is still very young. Many of its disciplines remain cluttered with unsubstantiated doctrine or belief, but its progress is inexorable and the pace of this progress is certainly quickening. Science with its questioning of long accepted theories and beliefs and its gradually increasing comprehension of the universal order, is *the* fundamental fact of the modern world. It is unquestionably destined, and perhaps quite soon, to become the ground substance of human thought and belief and thus a major determinant of human behavior. As this occurs an age of science on this earth will come into full being.

This is certainly no time to throw stones. It was not so long ago that medicine considered a normal pregnancy to be an illness and treated it as such. Only recently has the success of early ambulation after a major operation overcome the doctrine that a prolonged period of rest in bed was needed. The routine anticoagulation of the blood after a suspected myocardial infarction is still doctrine in debate.

It would seem that the lesson to be learned from all this is that we must get on with the business of understanding the inherent order in life and in the universe, and then get on with the business of helping human beings adapt themselves and their earthly environment to the realities of this inherent order. Medicine, with the help of others in many walks of life, can do much to bring this about. As this is done the age of science will come to its full stature, and any doctrine which is not of the ground substance of science will be remembered only for its historic interest.

Guest Editorial

Vectorcardiography

VECTORCARDIOGRAPHY, TRADITIONALLY limited by the paucity of trained interpreters and the scarcity of the cumbersome equipment as well as the confusing welter of techniques employed, has come of age. Most of the limitations mentioned have been overcome and the technique has much to offer the internist and the general practitioner in his own community hospital, although at present the service is available in less than five percent of hospitals having fewer than 500 beds.

The vectorcardiograph itself has been reduced in size and complexity over the past ten years. Very satisfactory machines are available which are as small and compact as an electrocardiographic machine and light enough to be transported easily to and from the hospital by the cardiologist. Of several methods of recording the cathode tube image, the Polaroid® film technique seems to us the most convenient because the film is instantly available. The Frank method of applying the electrodes has been widely adopted in recent years owing to its simplicity and the relatively slight distortion. Since 1964 we have used this convenience to make vectorcardiography available to two non-teaching, so-called community hospitals, one of 100 and the other of 200 beds. Our experience over these four years suggests that vectorcardiography does indeed have something to offer in the interpretation of cardiac status. In our experience the procedure finds its greatest usefulness in the following situations:

- Where myocardial infarction is suspected but the scalar electrocardiogram is equivocal.
- In localizing infarction of the myocardium where the scalar electrocardiogram is “silent.”
- In evaluating chamber hypertrophy.
- In evaluating conduction abnormalities.

The procedure is of distinctly less value than the scalar electrocardiogram in the determination of cardiac rhythm.

The following situations are offered as practical applications of the manner in which analysis of the vectorial display on the oscilloscope can help the cardiologist in resolving the common, day-to-day dilemmas which confront him in the interpretation of scalar electrocardiograms. These examples are intended to be illustrative only and are obviously not intended as complete diagnostic criteria.

* (Webster's Third New International Dictionary—Unabridged.)

The Vectorcardiogram in Myocardial Infarction

1. The q Wave in Lead aVf

Every practicing electrocardiographer does daily battle with the problem of the significance of the q wave in leads III and aVf and frequently ends with the equivocal, "Old inferior infarction cannot be ruled out." Using the Frank technique, an initial superior force of greater than 0.025 seconds in the sagittal and frontal planes, while not infallible, affords greater evidence of the pathologic significance of the ubiquitous q aVf. An initial superior force of less than 0.02 seconds, while less diagnostic, affords some further evidence that the q wave in this position may not be significant.

2. The Small or Absent r Wave in Leads V_1 and V_2 (V_3)

This dilemma is another daily trial to the physician who interprets electrocardiograms in a hospital. The patient who has "poor r wave progression" across the precordium may have the residuals of an old anteroseptal infarction, or he may have a normal heart slightly rotated, or he may have nothing more serious than poorly applied test leads. In the Frank system the lack of an anterior force as manifest by a 0.02 second vector which is posterior to the main horizontal axis in the horizontal plane may be of considerable help in evaluating a very small or absent r wave in V_1 or V_2 and in V_3 . One must bear in mind, of course, that similar posterior orientation of the 0.02 second vector may also be seen in aortic stenosis, pronounced left ventricular hypertrophy, left bundle branch block and type B Wolff-Parkinson-White syndrome. But these ordinarily offer no confusion on the scalar electrocardiogram. The presence of a 0.02 second vector anteriorly in the horizontal and sagittal plane might help persuade the electrocardiographer that "poor r wave progression" may be positional.

3. The "True Posterior Wall" Infarct

Because the scalar electrocardiogram is essentially "blind" to the true posterior wall of the heart, the term *posterior infarction* has loosely come to include infarctions involving the diaphragmatic surface of the left ventricle. Although it is possible to suspect a "true posterior wall" in-

farct from a tall, wide r wave in V_1 , the diagnosis is very much abetted by a vectorcardiogram which shows a loss of posterior force and an exaggeration of anterior force in the horizontal and sagittal displays. Since right ventricular hypertrophy or Wolff-Parkinson-White syndrome can be confusing, careful analysis is necessary but the vectorcardiogram offers the possibility for diagnosis that simply does not exist in the scalar electrocardiogram. The term *posterior wall infarction* should properly be reserved for involvement of the true back of the heart, leaving the term *inferior wall infarction* or *diaphragmatic infarction* to describe involvement of the diaphragmatic surface of the left ventricle.

Myocardial Infarction Complicating Left Bundle Branch Block

Recognition of myocardial infarction in the presence of left bundle branch block is possible but difficult. The presence on the vectorcardiogram of a tiny initial posterior leftward force in a vectorial display which otherwise is characteristic of left bundle branch block is highly suggestive of infarction of the septum. It is this tiny initial posterior leftward force which is responsible for the characteristic q wave which may appear on the scalar electrocardiogram in V_6 . Unfortunately because of its inherent "low fidelity" this q wave is often masked on the conventional electrocardiogram.

Chamber Hypertrophy

The diagnosis of right ventricular hypertrophy in the presence of right bundle branch block is greatly facilitated by the examination of vectorial display where the characteristic patterns associated with these conditions are widely different, one from the other. The late, slow anterior rightward forces of a typical right bundle branch block can be easily and clearly differentiated from the early anterior and rightward forces of typical right bundle branch block.

It is to be hoped that the increasing convenience and availability of vectorcardiographic equipment and the repeated confirmation of the usefulness of the technique will encourage more cardiologists to familiarize themselves with it.

ARTHUR D. SILK, M.D.